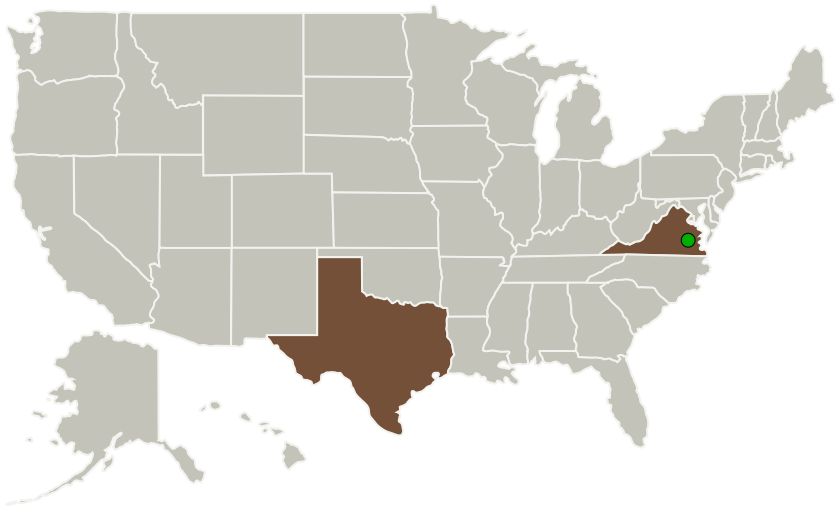
Plenoptic Flow Imaging for Ground Testing, Phase I

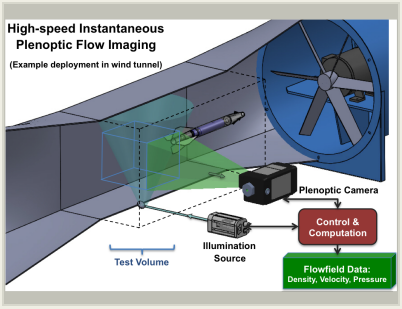
Completed Technology Project (2015 - 2015)

Project Introduction

Instantaneous volumetric flow imaging is crucial to aerodynamic development and testing. Simultaneous volumetric measurement of flow parameters enables accurate capture of temporally dynamic or transient flow phenomena. Nanohmics, Inc. proposes to develop a high-speed, high-resolution plenoptic lightfield flow imaging system to capture a rapid time sequence of simultaneously measured density, velocity and pressure throughout a test volume seeded for laser-induced fluorescence (LIF). The plenoptic imager leverages Nanohmics' existing AOI Plenoptic technology based on commercial-off-the-shelf components, providing a rapid route to commercialization. The proposed Nanohmics plenoptic flow imager is instantaneous and therefore able to capture rapidly evolving or oscillatory flow phenomena such as turbulence or vortices (unlike existing plane-scanning techniques). Our Phase II objectives include capture rates of 200,000 Hz or more, and volumetric resolution of over one million volume elements (voxels) – well beyond existing volumetric flow imaging demonstrations. We will leverage two of Nanohmics' current core technologies: our AOI Plenoptic lightfield camera (currently at TRL 7) and our FlashLED illumination system (currently at TRL 6). Leveraging efficient computation hardware developed for plenoptic (wavefront sensing) applications, we will extend our existing plenoptic 3D processing algorithms and to enhance the extraction of volumetric flow density, and combine these with iterative application of fluid equations to extract volumetric velocity and pressure fields. The Phase I objective is to design and fabricate an instantaneous volumetric 3D plenoptic flow imaging system, tested in a wind tunnel seeded for laser-induced fluorescence. The Phase II objective includes increases in speed and resolution, and advancing to TRL 7.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Nanohmics, Inc.	Lead Organization	Industry	Austin, Texas
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Texas	Virginia

Project Transitions

June 2015: Project Start

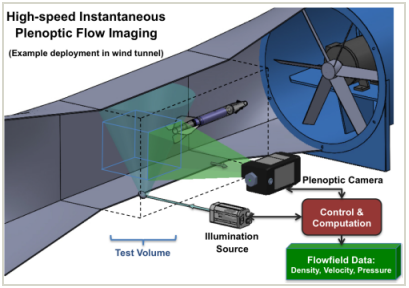
December 2015: Closed out

Closeout Summary: Plenoptic Flow Imaging for Ground Testing, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139337)*

Images



Briefing Chart Image
Plenoptic Flow Imaging for Ground Testing, Phase I
(https://techport.nasa.gov/image/131636)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Nanohmics, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

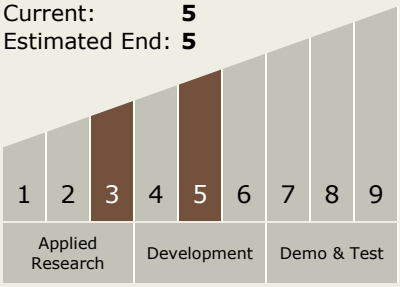
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Mark Lucente

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.1 Aerodynamics

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System